

WHAT IS CLAIMED IS:

1 1. A feed forward amplifier system, comprising:
2 an input for receiving an RF input signal;
3 a first control loop coupled to the input and comprising a main amplifier, a
4 main amplifier sampling coupler, a delay element, and a cancellation combiner;
5 a second control loop coupled to the first control loop and comprising a
6 first signal path, a second signal path comprising an error amplifier, and an error
7 coupler coupling the first and second signal paths;
8 an output coupled to the error coupler; and
9 means for controlling at least one of the first and second control loops
10 employing an alignment list having a plurality of list elements, each element
11 having an alignment setting and a collection of parameters characterizing the
12 operating condition of the feed forward amplifier system.

1 2. A feed forward amplifier system as set out in claim 1, wherein said first control
2 loop further comprises a gain adjuster and a phase adjuster and wherein each
3 said alignment setting comprises a loop 1 gain adjuster setting and a loop 1
4 phase adjuster setting.

1 3. A feed forward amplifier system as set out in claim 1, wherein said second
2 control loop further comprises a gain adjuster and a phase adjuster and wherein
3 each said alignment setting comprises a loop 2 gain adjuster setting and a loop 2
4 phase adjuster setting.

1 4. A feed forward amplifier system as set out in claim 1, wherein said collection of
2 parameters characterizing the operating condition of the feed forward amplifier
3 system comprises one or more of temperature, DC power supply, input signal
4 power and input signal carrier frequency.

1 5. A feed forward amplifier system as set out in claim 4, wherein said collection of
2 parameters characterizing the operating condition of the feed forward amplifier

3 system are defined as an attribute vector and a distance is defined between any
4 two attribute vectors.

1 6. A feed forward amplifier system as set out in claim 5, wherein said means for
2 controlling obtains a current attribute vector and computes the distance to the
3 attribute vectors of the list elements and selects the list element with the least
4 distance for use as an alignment setting in the control function.

1 7. A feed forward amplifier system as set out in claim 6, wherein said means for
2 controlling continually measures misalignment of the feed forward amplifier
3 system and retrieves an alignment setting from said alignment list when said
4 measured misalignment exceeds a predetermined value.

1 8. A feed forward amplifier system as set out in claim 7, wherein said means for
2 controlling employs a selected element as an initial alignment setting and
3 computes a new alignment setting from the initial setting employing an iterative
4 control algorithm.

1 9. A feed forward amplifier system as set out in claim 8, wherein said means for
2 controlling updates said alignment list with a new alignment setting after
3 completing said iterative computation.

1 10. A feed forward amplifier system as set out in claim 5, wherein the distance
2 between closest list element attribute vectors varies throughout the list.

1 11. An adaptive controller for controlling a loop of an amplifier system,
2 comprising:
3 one or more inputs for receiving one or more attribute parameters
4 corresponding to current operating conditions of the amplifier system; and
5 one or more processors coupled to said one or more inputs and having an
6 associated alignment list and programmed with an alignment list algorithm and a
7 controller algorithm to provide loop adjustment settings to control the loop of the

8 amplifier system, wherein said alignment list algorithm generates said list with
9 adjustment settings computed by said controller algorithm and associates one or
10 more attribute parameters with each adjustment setting.

1 12. An adaptive controller for controlling a loop of an amplifier system as set out
2 in claim 11, wherein said alignment list algorithm selects an alignment setting
3 from said alignment list for use by said controller algorithm at start up or when the
4 loop becomes sufficiently misaligned.

1 13. An adaptive controller for controlling a loop of an amplifier system as set out
2 in claim 12, wherein said alignment list algorithm selects an alignment list
3 adjustment setting for use by said controller algorithm by computing the distance
4 between the one or more attribute parameters corresponding to current operating
5 conditions and the attribute parameters associated with each of the alignment
6 settings in the list and selecting the alignment setting corresponding to the
7 attribute parameter with the minimum distance.

1 14. An adaptive controller for controlling a loop of an amplifier system as set out
2 in claim 12, wherein the distance computation is weighted with different weights
3 for different attribute parameters.

1 15. An adaptive controller for controlling a loop of an amplifier system as set out
2 in claim 11, wherein the attribute parameters comprise one or more of
3 temperature, DC supply voltage, input signal power and input signal carrier
4 frequency.

1 16. An adaptive controller for controlling a loop of an amplifier system as set out
2 in claim 14, wherein the distance d_{attr} between two sets of attribute parameters
3 "n" and "0", is defined by the weighted L_{inf} norm distance measure or the
4 weighted L_2 norm distance measure.

1 17. An adaptive controller for controlling a loop of an amplifier system as set out
2 in claim 11, further comprising one or more inputs for receiving alignment data.

1 18. An adaptive controller for controlling a loop of an amplifier system as set out
2 in claim 17, wherein said one or more inputs for receiving alignment data
3 comprises a pilot signal input.

1 19. An adaptive controller for controlling a loop of an amplifier system as set out
2 in claim 17, wherein said one or more inputs for receiving alignment data
3 comprises an input for loop test data.

1 20. An adaptive controller for controlling a loop of an amplifier system as set out
2 in claim 11, wherein said adjustment settings comprise gain adjuster and phase
3 adjuster settings.

1 21. A method for controlling an amplifier system having a control loop comprising
2 a control loop input, a first signal path, a second signal path, and a control loop
3 output, at least one of said first and second signal paths including an amplifier,
4 said method comprising:
5 providing a list of alignment settings, each alignment setting having an
6 associated operating condition;
7 detecting the current operating conditions of the amplifier system;
8 comparing the current operating conditions to those in the list of alignment
9 settings; and
10 selecting the alignment setting associated with the most similar operating
11 condition in the list.

1 22. A method for controlling an amplifier system as set out in claim 21, wherein
2 the relevant operating conditions are configured as a multi-dimensional attribute
3 vector.

1 23. A method for controlling an amplifier system as set out in claim 22, wherein
2 said comparing comprises measuring a distance between the current attribute
3 vector and each of the attribute vectors of the list.

1 24. A method for controlling an amplifier system as set out in claim 23, wherein
2 said selecting comprises determining the attribute vector having minimum
3 distance from the current operating condition attribute vector.

1 25. A method for controlling an amplifier system as set out in claim 21, further
2 comprising computing a new alignment setting employing an iterative loop
3 controller algorithm, wherein the alignment setting associated with the most
4 similar operating condition is used as the initial alignment setting for the adaptive
5 loop controller algorithm.

1 26. A method for controlling an amplifier system as set out in claim 25, further
2 comprising updating the alignment list with a new alignment setting computed by
3 the adaptive loop controller algorithm.

1 27. A method for controlling an amplifier system as set out in claim 21, wherein
2 the size of the alignment list is dynamic.

1 28. A method for controlling an amplifier system as set out in claim 23, wherein
2 the spacing of the stored adjustment settings, as defined by the attribute vector
3 distance, varies through the list.

1 29. A method for controlling an amplifier system as set out in claim 28, wherein a
2 higher density of adjustment settings is provided in regions of the list where the
3 alignment is most sensitive to one or more operating conditions comprising the
4 attribute vector.

1 30. A method of maintaining a list of alignment settings of a control loop of an
2 amplifier system, said list comprising a plurality of elements each element having
3 an alignment setting and a set of parameters corresponding to operating
4 conditions of the amplifier system, said method comprising:

5 selecting an element of the alignment list;

6 determining the element of the alignment list having the most similar
7 corresponding operating conditions to the selected element;

8 determining if the two elements are sufficiently similar to be considered
9 redundant; and

10 deleting the oldest of the two elements of the alignment list if the elements
11 are redundant.

1 31. A method of maintaining a list of alignment settings of a control loop of an
2 amplifier system as set out in claim 30, wherein said selecting an element of the
3 alignment list comprises selecting the oldest element of the list not previously
4 subject to list maintenance processing.

1 32. A method of maintaining a list of alignment settings of a control loop of an
2 amplifier system as set out in claim 30, wherein said determining the element of
3 the alignment list having the most similar corresponding operating conditions to
4 the selected element comprises determining a distance measure to the operating
5 condition parameter values of each of the remaining elements of the alignment
6 list and selecting the element having the minimum distance.

1 33. A method of maintaining a list of alignment settings of a control loop of an
2 amplifier system as set out in claim 32, wherein said distance measure
3 comprises a weighted difference between parameter values corresponding to
4 operating conditions.

1 34. A method of maintaining a list of alignment settings of a control loop of an
2 amplifier system as set out in claim 33, wherein said parameters corresponding

3 to operating conditions of the amplifier system comprise one or more of
4 temperature, DC power supply, input signal power and input signal carrier
5 frequency.

1 35. A method of maintaining a list of alignment settings of a control loop of an
2 amplifier system as set out in claim 30, wherein said determining if the elements
3 are sufficiently similar to be considered redundant comprises determining a
4 distance measure between the alignment settings and comparing the alignment
5 distance to a redundant distance threshold.

1 36. A method of maintaining a list of alignment settings of a control loop of an
2 amplifier system as set out in claim 32, wherein said determining if the elements
3 are sufficiently similar to be considered redundant comprises comparing the
4 distance between the operating condition parameters of the two elements to an
5 outdated distance threshold.

1 37. A method of maintaining a list of alignment settings of a control loop of an
2 amplifier system as set out in claim 30, further comprising repeating said list
3 maintenance processing for each element of the alignment list.

1 38. A method of generating a hierarchical list of alignment settings of a control
2 loop of an amplifier system, said list comprising a plurality of elements each
3 element having an alignment setting and a corresponding set of parameters
4 corresponding to operating conditions of the amplifier system, said list having a
5 hierarchical structure comprising at least two levels, said method comprising:
6 selecting an element in a first level of the alignment list;
7 determining the element of the first level of the alignment list having the
8 most similar corresponding operating conditions to the selected element; and
9 demoting the oldest of the two elements to a lower level of the hierarchical
10 alignment list.

1 39. A method of generating a hierarchical list of alignment settings of a control
2 loop of an amplifier system as set out in claim 38, wherein said determining the
3 element of the alignment list having the most similar corresponding operating
4 conditions to the selected element comprises determining a distance measure to
5 the operating conditions of each of the remaining elements of the first level of the
6 alignment list and selecting the element having the minimum distance.

1 40. A method of generating a hierarchical list of alignment settings of a control
2 loop of an amplifier system as set out in claim 38, further comprising determining
3 if the two elements are redundant, wherein said older element is only demoted if
4 the elements are redundant.

1 41. A method of generating a hierarchical list of alignment settings of a control
2 loop of an amplifier system as set out in claim 38, further comprising repeating
3 said list processing for each level of the hierarchical list.

1 42. A method of generating a hierarchical list of alignment settings of a control
2 loop of an amplifier system as set out in claim 41, wherein said older entry is
3 deleted if the list maintenance processing is at the lowest level of the hierarchy.

1 43. A method of generating a hierarchical list of alignment settings of a control
2 loop of an amplifier system as set out in claim 38, wherein said demoted element
3 is associated as a subset list entry of the redundant element not demoted.

1 44. A method of generating a hierarchical list of alignment settings of a control
2 loop of an amplifier system as set out in claim 43, wherein an element being
3 demoted and having a subset list is merged with the subset list of a redundant
4 element not demoted.

1 45. A method for controlling an amplifier system having a control loop comprising
2 a control loop input, a first signal path, a second signal path, and a control loop

3 output, at least one of said first and second signal paths including an amplifier,
4 said method comprising:

5 providing a hierarchical list of alignment settings having at least two levels,
6 each alignment setting having an associated operating condition and some or all
7 of the alignment settings in a highest level having subset alignment settings in a
8 lower level;

9 detecting the current operating conditions of the amplifier system;

10 comparing the current operating conditions to those in the highest level of
11 the hierarchical list of alignment settings;

12 selecting the alignment setting associated with the most similar operating
13 condition in the highest level of the list;

14 comparing the current operating conditions to those in the subset of the
15 selected highest level alignment setting;

16 selecting the alignment setting of the subset with the most similar
17 operating condition; and

18 selecting the alignment setting in the higher or lower level having the most
19 similar operating condition to the current operating condition.

1 46. A method for controlling an amplifier system as set out in claim 45, further
2 comprising repeating the processing for each level of the hierarchical list until the
3 next lower subset is empty.

1 47. A method for controlling an amplifier system as set out in claim 45, wherein
2 the highest level has a coarser spacing of alignment settings than the lower level.

1 48. A method for controlling an amplifier system as set out in claim 47, wherein
2 any two alignment settings have an alignment distance and wherein the highest
3 level has a larger alignment distance between settings than said lower level.

1 49. A method for controlling an amplifier system as set out in claim 47, wherein
2 said alignment distance is a weighted difference between the adjustment
3 settings.

1 50. A method for controlling an amplifier system as set out in claim 49, wherein
2 the adjustment settings are a gain adjustment and phase adjustment setting and
3 wherein the weighting is an alignment sensitivity.